

CLAIMS

1. A process for producing an [n-5]-hydroxy fatty acid (n is an even number of 10 or more) wherein the [n-6]-position is a single bond, which comprises causing cells or a culture of a microorganism having the activity to introduce hydroxy into the [n-5]-position and hydrogen into the [n-6]-position of a straight-chain fatty acid having n carbon atoms wherein at least the [n-6]-position is a double bond to make the [n-6]-position a single bond (hereinafter referred to as the first microorganism) or a treated matter thereof to act on a straight-chain fatty acid having n carbon atoms wherein at least the [n-6]-position is a double bond or a composition containing the fatty acid to form the [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond, and recovering the formed [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond.

2. The process according to claim 1, wherein the double bond at the [n-6]-position is the cis-form.

3. The process according to claim 1 or 2, wherein the first microorganism has the activity to introduce hydroxy into the 13-position and hydrogen into the 12-position of linoleic acid, α -linolenic acid or γ -linolenic acid to make the 12-position a single bond.

4. The process according to any of claims 1 to 3, wherein the first microorganism is a lactic acid bacterium or bifidobacterium.

5. The process according to any of claims 1 to 3, wherein the first microorganism belongs to the genus Pediococcus or Bifidobacterium.

6. The process according to any of claims 1 to 3, wherein

the first microorganism is Pediococcus pentosaceus or Bifidobacterium bifidum.

7. The process according to any of claims 1 to 3, wherein
5 the first microorganism is Pediococcus pentosaceus IFO3891, Pediococcus sp. IFO3778 or Bifidobacterium bifidum JCM7002.

8. The process according to any of claims 1 to 7, wherein
10 the straight-chain fatty acid having n carbon atoms (n is an even number of 10 or more) wherein at least the [n-6]-position is a double bond is linoleic acid and the [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond is 13-hydroxy-9-octadecenoic acid.

9. The process according to any of claims 1 to 7, wherein
15 the straight-chain fatty acid having n carbon atoms (n is an even number of 10 or more) wherein at least the [n-6]-position is a double bond is α -linolenic acid and the [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond is
20 13-hydroxy-9,15-octadecadienoic acid.

10. The process according to any of claims 1 to 7, wherein
the straight-chain fatty acid having n carbon atoms (n is an even number of 10 or more) wherein at least the [n-6]-position
25 is a double bond is γ -linolenic acid and the [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond is 13-hydroxy-6,9-octadecadienoic acid.

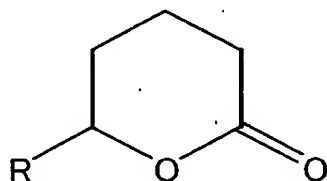
30 (11). 13-Hydroxy-6,9-octadecadienoic acid represented by the following formula (I):



(12). A process for producing a δ -lactone, which comprises

causing cells or a culture of the first microorganism or a treated matter thereof to act on a straight-chain fatty acid having n-carbon atoms (n is an even number of 10 or more) wherein at least the [n-6]-position is a double bond or a composition containing the fatty acid to form an [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond, causing cells or a culture of a microorganism having the activity to β -oxidize an [n-5]-hydroxy fatty acid wherein the [n-6]-position is a single bond (hereinafter referred to as the second microorganism) or a treated matter thereof to act on the formed [n-5]-hydroxy fatty acid, and recovering the formed δ -lactone.

13. The process according to claim 12, wherein the δ -lactone is a δ -lactone represented by the following formula (II):



(II)

(wherein R represents n-pentyl or n-pentenyl).

14. The process according to claim 12, wherein the δ -lactone is δ -decalactone or jasmine lactone.

15. The process according to any of claims 12 to 14, wherein the double bond at the [n-6]-position is the cis-form.

16. The process according to any of claims 12 to 15, wherein the first microorganism has the activity to introduce hydroxy into the 13-position and hydrogen into the 12-position of linoleic acid, α -linolenic acid or γ -linolenic acid to make the 12-position a single bond.

17. The process according to any of claims 12 to 15,

Linoleic: $\text{HO}-\text{C}(1)-\text{C}(2)=\text{C}(3)-\text{C}(4)-\text{C}(5)-\text{C}(6)-\text{C}(7)-\text{C}(8)-\text{C}(9)-\text{C}(10)-\text{C}(11)-\text{C}(12)=\text{C}(13)-\text{C}(14)-\text{C}(15)-\text{C}(16)-\text{C}(17)-\text{C}(18)$

Linolenic: $\text{HO}-\text{C}(1)-\text{C}(2)=\text{C}(3)-\text{C}(4)-\text{C}(5)-\text{C}(6)-\text{C}(7)-\text{C}(8)-\text{C}(9)=\text{C}(10)-\text{C}(11)-\text{C}(12)=\text{C}(13)-\text{C}(14)-\text{C}(15)-\text{C}(16)-\text{C}(17)-\text{C}(18)$

$\alpha\beta\delta\gamma$

\uparrow
OH

$n-6 = 18-6 = 12$
 $n-5 = 18-5 = 13$

γ

wherein the first microorganism is a lactic acid bacterium or bifidobacterium.

18. The process according to any of claims 12 to 15,
5 wherein the first microorganism belongs to the genus Pediococcus or Bifidobacterium.

19. The process according to any of claims 12 to 15,
10 wherein the first microorganism is Pediococcus pentosaceus or Bifidobacterium bifidum.

20. The process according to any of claims 12 to 15,
15 wherein the first microorganism is Pediococcus pentosaceus IFO3891, Pediococcus sp. IFO3778 or Bifidobacterium bifidum JCM7002.

21. The process according to any of claims 12 to 20,
wherein the second microorganism is a yeast.

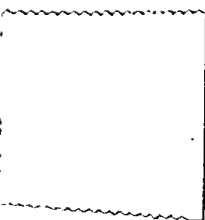
22. The process according to any of claims 12 to 20,
20 wherein the second microorganism belongs to the genus Kluyveromyces, Zygosaccharomyces, Pichia or Saccharomyces.

23. The process according to any of claims 12 to 20,
25 wherein the second microorganism is Kluyveromyces marxianus, Kluyveromyces thermotolerans, Kluyveromyces wickerhamii, Zygosaccharomyces rouxii, Zygosaccharomyces bailii, Zygosaccharomyces cidri, Pichia jadinii or Saccharomyces cerevisiae.

30 24. The process according to any of claims 12 to 20,
wherein the second microorganism is Kluyveromyces marxianus IFO1090, Kluyveromyces thermotolerans ATCC24177, Kluyveromyces wickerhamii ATCC24178, Zygosaccharomyces rouxii NFR2007, Zygosaccharomyces bailii ATCC8766, Zygosaccharomyces cidri ATCC46819, Pichia jadinii IFO0987 or Saccharomyces

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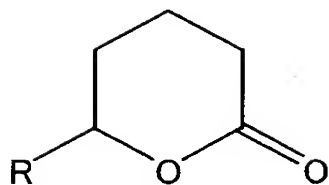
25. The process according to any of claims 12 to 24,
wherein the straight-chain fatty acid having n carbon atoms
5 (n is an even number of 10 or more) wherein at least the
[n-6]-position is a double bond is linoleic acid and the δ -
lactone is δ -decalactone.

26. The process according to any of claims 12 to 24,
10 wherein the straight-chain fatty acid having n carbon atoms
(n is an even number of 10 or more) wherein at least the
[n-6]-position is a double bond is α -linolenic acid and the
 δ -lactone is jasmine lactone.

27. The process according to any of claims 12 to 26,
15 wherein the composition is a natural oil or fat or a hydrolyzate
thereof.

28. A process for producing a ^{Food} composition containing
20 a δ -lactone, which comprises causing cells or a culture of
the first microorganism or a treated matter thereof to act on
a composition containing a straight-chain fatty acid having
n carbon atoms (n is an even number of 10 or more) wherein at
least the [n-6]-position is a double bond to form an [n-5]-hydroxy
25 fatty acid wherein the [n-6]-position is a single bond in the
composition, and then causing cells or a culture of the second
microorganism or a treated matter thereof to act on the formed
[n-5]-hydroxy fatty acid. *no recovery*

29. The process according to claim 28, wherein the δ -
30 lactone is a δ -lactone represented by the following formula
(II):



(II)

(wherein R represents n-pentyl or n-pentenyl).

5. 30. The process according to claim 29, wherein the δ -lactone is δ -decalactone or jasmine lactone.

- 10 31. The process according to any of claims 28 to 30, wherein the double bond at the [n-6]-position is the cis-form.

- 15 32. The process according to any of claims 28 to 31, wherein the first microorganism has the activity to introduce hydroxy into the 13-position and hydrogen into the 12-position of linoleic acid, α -linolenic acid or γ -linolenic acid to make the 12-position a single bond.

- 20 33. The process according to any of claims 28 to 31, wherein the first microorganism is a lactic acid bacterium or bifidobacterium.

- 25 34. The process according to any of claims 28 to 31, wherein the first microorganism belongs to the genus Pediococcus or Bifidobacterium.

- 30 35. The process according to any of claims 28 to 31, wherein the first microorganism is Pediococcus pentosaceus or Bifidobacterium bifidum.

36. The process according to any of claims 28 to 31, wherein the first microorganism is Pediococcus pentosaceus IF03891, Pediococcus sp. IF03778 or Bifidobacterium bifidum JCM7002.

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37. The process according to any of claims 28 to 36, wherein the second microorganism is a yeast.

38. The process according to any of claims 28 to 36, wherein the second microorganism belongs to the genus Kluyveromyces, Zygosaccharomyces, Pichia or Saccharomyces.

39. The process according to any of claims 28 to 36, wherein the second microorganism is Kluyveromyces marxianus, Kluyveromyces thermotolerans, Kluyveromyces wickerhamii, Zygosaccharomyces rouxii, Zygosaccharomyces bailii, Zygosaccharomyces cidri, Pichia jadinii or Saccharomyces cerevisiae.

40. The process according to any of claims 28 to 36, wherein the second microorganism is Kluyveromyces marxianus IFO1090, Kluyveromyces thermotolerans ATCC24177, Kluyveromyces wickerhamii ATCC24178, Zygosaccharomyces rouxii NFR2007, Zygosaccharomyces bailii ATCC8766, Zygosaccharomyces cidri ATCC46819, Pichia jadinii IFO0987 or Saccharomyces cerevisiae Kyokai No. 701.

41. The process according to any of claims 28 to 40, wherein the straight-chain fatty acid having n carbon atoms (n is an even number of 10 or more) wherein at least the [n-6]-position is a double bond is linoleic acid and the δ -lactone is δ -decalactone.

42. The process according to any of claims 28 to 40, wherein the straight-chain fatty acid having n carbon atoms (n is an even number of 10 or more) wherein at least the [n-6]-position is a double bond is α -linolenic acid and the δ -lactone is jasmine lactone.

43. The process according to any of claims 28 to 42, wherein the composition is a food.

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44. The process for producing a food containing a δ -lactone, which comprises adding to a food the δ -lactone produced by the process according to any of claims 12 to 27 or the composition containing the δ -lactone produced by the process according to any of claims 28 to 42.

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